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Chaotic synchronization of the wall turbulence SEDAT TARDU, LEGI, B.P. 53 X, 38041 Grenoble, France — Multiscale edge detection wavelet analysis is applied to the streamwise velocity fluctuations in the buffer layer through direct numerical simulations. The wavelet coefficients are rewritten using analytic signal approach to sort out their local amplitudes and wavenumbers. Large zones of approximately constant wavenumbers have been identified at different scales, and a parallelism is constructed between these observations and stochastic synchronization phenomena. The results we analyze strongly suggest that the wall turbulence is chaotically synchronized with the forcing induced by convecting coherent vortices near the wall, thus comforting our earlier results based on experimental velocity and wall shear stress time series (Tardu, Phys. Fluids, 2007). The spatial extend of phase-locked, synchronized zones feature a clear type I intermittency behaviour. The local amplitude intermittency in the synchronized zones is low, and the small-scale amplitude intermittency increases significantly when they are suppressed. The type I intermittency disappears in the viscous and log layers. These results suggest some wall turbulence control strategies that are similar to chaos control methodology (Tardu, Chaos 2010).

Sedat Tardu
LEGI, B.P. 53 X, 38041 Grenoble, France

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